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Factsheet

HARVESTING AND STORING BIG BALE HAYLAGE

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Round bale haylage, with its potential for high-quality feed, very low waste and moderate costs, has been gaining popularity amongst Ontario's livestock farmers. For most producers, round bale haylage is a secondary haying system, implemented to save a mowed field from a threatening rainstorm or when extremely high humidity interferes with p' hay curing. It allows the use of hay-making equipment for harvesting haylage, and no storage structure is required. When silo capacity is lacking due to fc rage surplus, round bale haylage can also offer an effective method of storing additional forage.

Putting up baled hay lage will also provide the edge in quality feed that haylage has over baled hay. Harvesting haylage at 55% moisture as opposed to dry hay at 18% can cut harvest and storage losses in half (Figure 1). Dry matter losses, largely the result of shattering and loss of protein-rich leaves, are cut substantially by harvesting a wetter material.

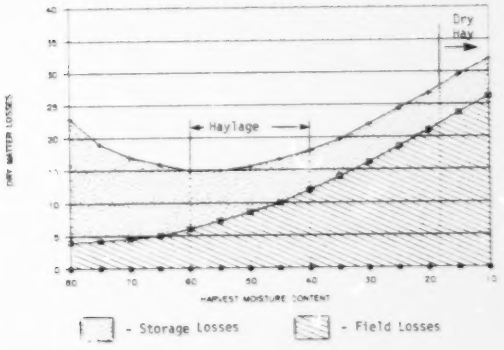

Figure 1 Losses Increase With Dry Hay

Only top quality forage should be used for round bale haylage. Poor quality, rain-damaged material, or a forage crop that is mature and lacks the sugars necessary for good fermentation, will not produce quality feed.

HARVEST

Wilt the crop to about 55% moisture. At this moisture level, fermentation is more favorable in terms of sugar content than in wetter material, and seepage losses are minimized. The amount of forage mowed must be co-ordinated closely with drying conditions, baling and covering. If the crop gets much drier than 40% moisture, let it dry for hay. Ensiling material with too little moisture increases the risk of heating due to increased oxygen penetration, which will lead to mold growth and a marked depression in the protein digestibility.

Machinery for making and transporting heavier, high moisture bales, is required. Do not attempt to work with very large bales. A 4' x 4' bale at 55% moisture will weigh 1200 pounds.

It is important to move the bales to storage and enclose them in plastic as soon as possible after baling. No matter whether the haylage is put into individual bags or in stacks of bales, sealing all air out is critical. During the respiration stage of the ensiling process, the oxygen that is trapped in storage is rapidly consumed by aerobic bacteria. Anaerobic bacteria, which survive in the absence of oxygen, begin to grow and multiply in the fermentation stage and convert the plant sugars into organic acids — mainly lactic and acetic. With the production of acids, the acidity of the silage rises, reducing the pH from an original level of 7.0 to a final pH of approximately 4.0. Fermentation will cease when bacteria growth is stopped by the accumulation of acids. The haylage will then remain at a stable pH with no bacterial growth, and can be preserved for a long time, providing there is no exposure to air. The use of silage additives to aid fermentation is generally unnecessary, but may be beneficial in situations where forage material is drier than recommended or very high in protein.

STORAGE OPTIONS

A. Individual Bagging (Figure 2) is accomplished in 4 steps: (1) Unroll bags from the carton roll; (2) place the bale in the bag with a loader; (3) set the bale in place for storage; and (4) tie the neck of the bag tightly. If dealing with a large number of bales, the procedure will work best with three people.

Figure 2 Individually Bagged Haylage

Avoid making bales so large that they fit the bags tightly. Not only is extra time and effort required at bagging, but the potential for stem punctures is increased. (Once baled, the shell dries quickly, leaving sharp, tough stem ends exposed.) All bags should be checked for holes immediately after bagging and then periodically afterwards. Patching can be effective if done with minimal delay.

Bags for big bale haylage come in various sizes and thicknesses. The lighter bags are 4 mil polyethylene and have a one year life expectancy, while 5 and 5.5 mil bags will often provide 2 seasons of use if the farmer is willing to patch any holes before re-using. Keep in mind that even a pin-hole allows enough air exchange for spoilage to occur.

Holes created by mice will cause extensive spoilage, and if undetected long enough, may render the bale a complete waste. Avoid rodent damage by eliminating long grass at and around the storage site, and by placing any straw or hay bales well away.

Large hail stones have the ability to riddle plastic bags. Since patching is not viable in this case, re-bagging is the only way to extend the storage period for that silage. Other potential nuisances, which must not be ignored in trying to maintain sealed bags, are dogs, cats, cows and children.

B. Multi-Bale Bags or Tubes of polyethylene, and tube-filling machines have been developed to decrease the cost, labor and time required to bag individual bales. The simplest and most efficient piece of equipment developed for this approach is shown in Figure 3.

A 100' tube of plastic is mounted on the drum of this machine, and bagging proceeds with a front end loader used to set a bale into the unit. The bale is placed far enough through the unit that when the farmer backs up his tractor, he can lower the loader to engage the tongue, and then drag the unit ahead one bale length. He then retrieves another bale and continues to fill the bag. Not only is this an inexpensive machine which can be home-built, but the bagging procedure is a one man operation except for placing plastic on the drum (which requires two people).

Another bagger often used is the tractor-powered hydraulic unit (Figure 4). Again, the tube of plastic is placed on the drum of the machine, but the bagging procedure requires one person operating the hydraulics of the bagger while another brings bales to the machine with a loader.

Figure 4 Hydraulic Tube-Filling Unit

Some farmers have managed to do multiple bagging manually (without the bagger) with groups of 4 or 5 bales. Advantages of this approach are two-fold: (1) the potential for extensive spoilage is reduced; and, (2) the capital cost or rental of a bagger is avoided. Additional labor and slowdown of the bagging rate are the trade-offs for these benefits.

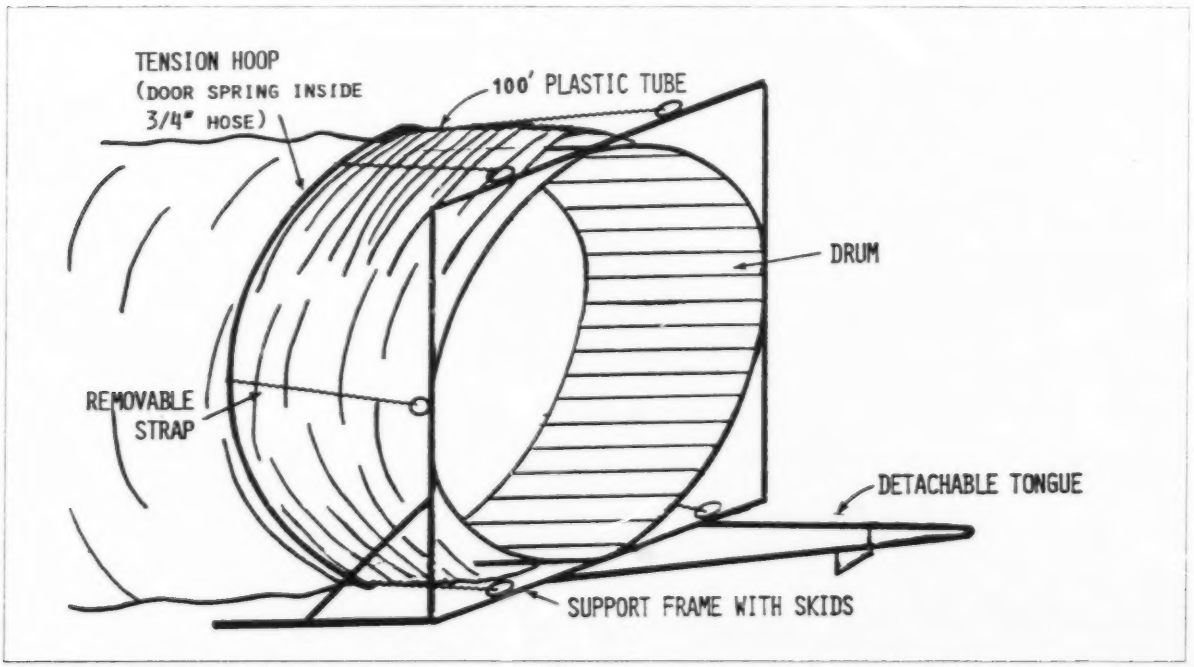

Figure 3 Home-Built Tube-Filling Unit

C. Wrapping big bales with "stretch" plastic has proven to be an effective storage alternative (Figure 5).

Figure 5 Stretch-Wrapped Bales

It is accomplished in either of 2 basic ways:

1. By a 3-point hitch-mounted spear which rotates the bale as a hand-held roll of stretch-wrap is gradually advanced along the bale. To wrap the ends of the bale, the plastic must be pulled around the bale lengthwise several times.

2. By machinery which rotates the bale on a turn table. The farmer starts the wrapping procedure by tucking the end of the plastic film under twine, and when wrapping is complete, cuts the wrapped bale free.

Other wrapping machines are being developed and will provide farmers with a variety of choices for wrapping bales. Depending on the machine, this is either a one or two-man operation.

Best results are expected when sound bales — that is, bales that will not "squat" — are wrapped as tightly as possible. A total of 4 thicknesses of the stretch-wrap material are required to provide a complete seal.

The biggest advantage offered by this system appears to be its potential to minimize spoilage. For tight, well-wrapped bales, a hole in the plastic will mean only localized mould and spoilage rather than the widespread spoilage which develops when loose-fitting plastic covers are punctured.

D. Stacks of big bales can be preserved by covering and sealing them with a double layer of 6 mil polyethylene. As shown in Figure 6, the outer layer provides the seal, while the inner layer protects it from stem punctures — especially where twine or rope tie-downs are placed. Earth is used to seal the edges of the outer layer, and substantial tie-downs are required to minimize wind buffeting.

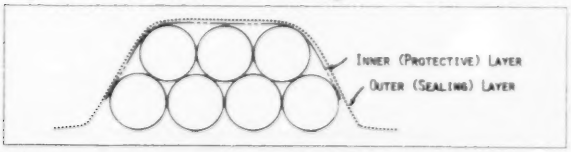

Figure 6 Building a Stack of Big Bale Haylage

Do not use construction grade polyethylene since a large percentage of it is made from a variety of reclaimed plastics, and thus it is an inferior product. On the other hand, silage films — though costing 20% more — are made from pure resins, and exhibit vastly superior physical properties (stretch, puncture, fatigue).

The amount of air initially trapped under the plastic is not critical, as that oxygen is quickly used-up by the respiration process. However, any subsequent hole in the plastic will allow oxygen to enter freely and cause extensive spoilage. As with the other options, steps should be taken to minimize rodent problems, and periodic checking of the cover should be practised.

Some farmers have chosen to place loose hay in the voids between bales, and between bales and the plastic cover. The benefit gained here is that the free movement of air through the stack may be lessened if the stack's seal is broken.

Stacks should not be built more than 2 bales high due to the tendency of these heavy bales to "squat" and become somewhat unstable. In a high stack there is potential for the top bales to shift in any direction — possibly breaking the polyethylene seal. (In a pit storage this concern is reduced as sidewalls limit lateral bale movement, and packing of the bales by four-wheel-drive tractors may be practised).

Once a stack is opened (Figure 7), deterioration of the haylage commences and continues at a rate which varies with air temperature. Eventually, mould becomes visible on the face of the bales, and gradually will penetrate the bales. Stack size should be planned such that once opened, it will be entirely fed out: — in summer, within 1 week; — in spring and fall, within 2 weeks; — in winter, within 4 weeks.

Figure 7 An Opened Stack of Big Bale Haylage

If stacks are kept small (30 to 35 bales), placing the plastic will be easier, and problems with ice and snow during winter feed-out will be minimized.

MOULDS

A farmer considering big bale haylage should accept that moulds are a fact of life. Even under ideal circumstances it appears as though a small percentage of bales will exhibit some white mould. A bale which has been exposed to oxygen for an extended period will exhibit severe black mould throughout much of the bale. The white mould shown on the end of the bale in Figure 8 may be the result of the bag being inadequately tied.

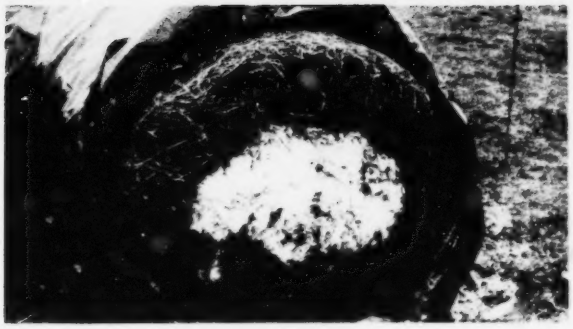

Figure 8 White Mould Formation

While no known research has looked at the effects of mouldy material on ruminants, farmer experience has not found it to be a problem (except for feed refusal with black moulded bales). However, the effort to minimize mould in big bale haylage should be the farmer's primary goal.

ECONOMICS

In considering the costs of storing big bale haylage, one must recognize the two-fold economic benefit provided by any of the storage options previously mentioned:

1. The plastic enclosures act as the storage facility that would have to be provided for either dry hay or haylage in any forage system (one exception being round bales stored outside).
2. The farmer is able to bring the maximum amount of dry matter from the field, as illustrated earlier in Figure 1.

If these two benefits are compared to a big bale system for dry hay in which the bales are stored outside, their combined effect would result in 25-30% more dry matter being available for feeding. At a market value of $60 per ton of dry hay, this would amount to more than a $15 per ton benefit. (Note that this comparison deals with the weight of usable product, and does not take into account the higher quality feed available compared to a dry hay system.)

Based on the above, the cost-per-ton values shown in Figure 9 suggest that storage costs for big bale silage are not unreasonable.

Figure 9 Costs of Storing Big Bale Haylage

Method, Materials and Equipment			Cost Per Bale*	Cost Per Ton*
Bags	If $5.50 for 4 mil black bags; one time use		$5.50	$14.65
	If $10.00 for 5 mil 2-ply bags; two uses		$10.00	$13.35
Tubes	If $85 for 100' of 5 mil tube; 18 bales per tube	Machine cost ** $600	$4.90	$13.05
		Machine cost ** $4000	$6.05	$16.15
Wrap	If $5.00 per bale for plastic	Machine cost $4000	$6.35	$17.00
		Machine cost $10,000	$8.80	$23.50
Stacks	If $190 for 40' x 100' sheet of 6 mil polyethylene***	2-3 stacking, 4 bale lengths, for a total of 20 bales per stack (40' x 33' outer layer)	$3.20	$8.55
		4-5 stacking, 15 bale lengths, for a total of 135 bales per stack (40' x 100' outer layer)	$1.40	$3.75

* *Table assumes 4' diameter x 5' bales, 1600 lbs. @ 60% moisture content or approximately 750 lbs. dry hay equivalent. 'Cost per Ton' refers to tons of dry hay.*

** *Machine cost based on 10-year payback @ 12% interest, 200 tons (534 bales) annual use.*

*** *Assume outer layer from year #1 can be re-used as inner layer in year #2, etc.*

LABOR

In evaluating any of the big bale haylage storage options, one must consider the labor component. Note that this component should be evaluated not only for harvest and storage, but also for any subsequent handling and feeding operations. With most big bale haylage systems, the farmer is substituting labor for the mechanization available in alternative forage systems.

CONCLUSION

Big bale haylage can provide an economical, quality forage product — especially for farmers who already own round balers, or for those who are not large enough to justify the expense of a conventional haylage system. However, for the beginner, it may be advisable to start small while "learning the ropes". That way, any initial mistakes will not be large ones.

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